Space Weather Technical Forecast

Issued on Monday 27 January 2025 at 01:06 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been at Low levels, with occasional C-class flares in the last 24 hours.

There are currently nine sunspot regions on the Earth-facing disc. The largest and nominally most complex region remains AR3961, located near the southwestern limb. This group has shown fading in its central and trailing portions, where a weak delta spot has previously been seen, but is now difficult to accurately assess due to the viewing angle near the limb. AR3971, a bipolar region approaching the northwest limb, is the largest of the other groups and has shown a weakening trend in recent imagery. AR3967, a small bipolar group in the southwest, has shown some growth and minor spot emergence. A new region emerging in the southeast has been numbered AR3974. Remaining regions are small and magnetically simple, and either stable or showing some weakening.

No Earth-directed CMEs have been seen in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, was at background levels, falling from 370 km/s to around 290 km/s. Density was below average. The Interplanetary Magnetic Field was weak, at 4nT or below, with the north-south component varying weakly between +2 and -1nT. The phi angle was negative (towards the Sun). Geomagnetic activity was Quiet (Kp0-1).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 was at background levels.

High energy electron flux (greater than 2MeV) at GOES16 was Moderate, with a diurnal peak of 940pfu seen at 26/1800 UTC. The associated 24-hour fluence persisted below the Active threshold, reaching 4.03e7 integrated pfu at 27/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate solar activity is expected with a chance of isolated M-class flares, and a slight chance of X-class flares.

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Solar Wind / Geomagnetic Activity: No new CMEs feature in the forecast. A previously forecast CME from 22 Jan has likely missed Earth, but could still arrive early on Day 1 (27 Jan), albeit with very low confidence. A coronal hole may be emerging in the northwest quadrant of the disc, however any influence from this feature is likely to be limited if at all.

Quiet activity (Kp0-2) is generally expected through the forecast period, with a very slight chance of Active to G1/Minor Storm (Kp4-5) intervals early Day 1 (27 Jan) should any late CME arrive.

Energetic Particles / Solar Radiation: There is a slight chance of enhancements exceeding the S1/Minor Radiation Storm threshold, should any larger flares occur from the western hemisphere.

GOES16 high energy electron flux is likely to show a gradual decline. The corresponding 24-hour fluence is expected to remain below the Active threshold on a declining trend.

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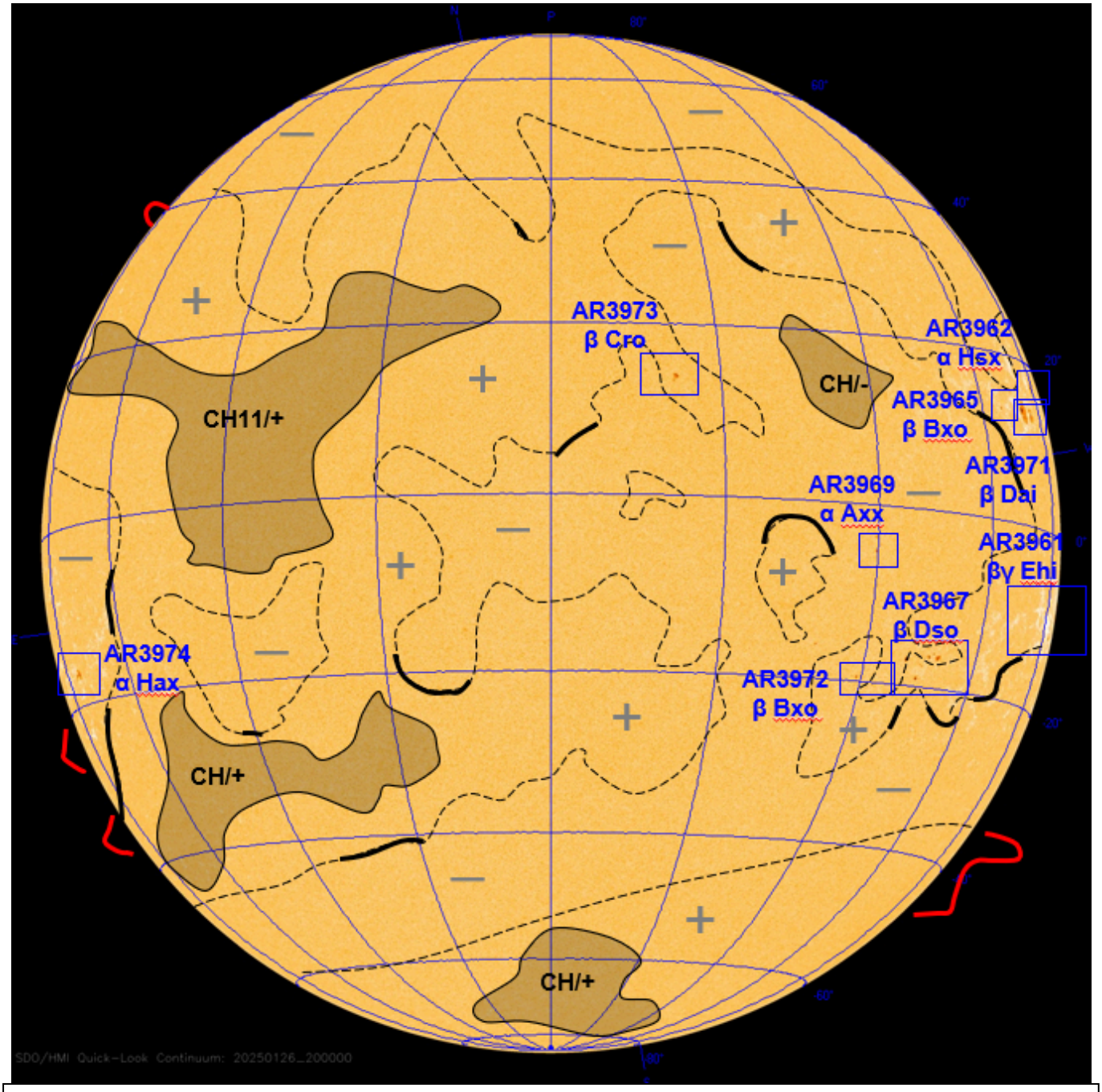
Figure 1: Solar Synoptic Map valid 26/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There are no new CMEs in the forecast. Two previous CMEs that featured in the forecast over the past few days are likely misses, although there remains a very slight chance for the 22 Jan CME to arrive early on 27 Jan, but this is low confidence.

Whilst a coronal hole may be emerging in the northwest quadrant of the disc, it is currently small and well north of the solar equator. With Earth now well to the south of the solar equator, any influence from this feature is expected to be limited if at all.

Quiet activity (Kp0-2) is generally expected through the forecast period, with a very slight chance of Active to G1/Minor Storm (Kp4-5) intervals early Day 1 (27 Jan) should any CME arrive.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
22/1727	Full	AR3961	S Centre	591	25/1800	CME very likely missed, but arrival during early Day 1 (27 Jan) cannot be ruled out.

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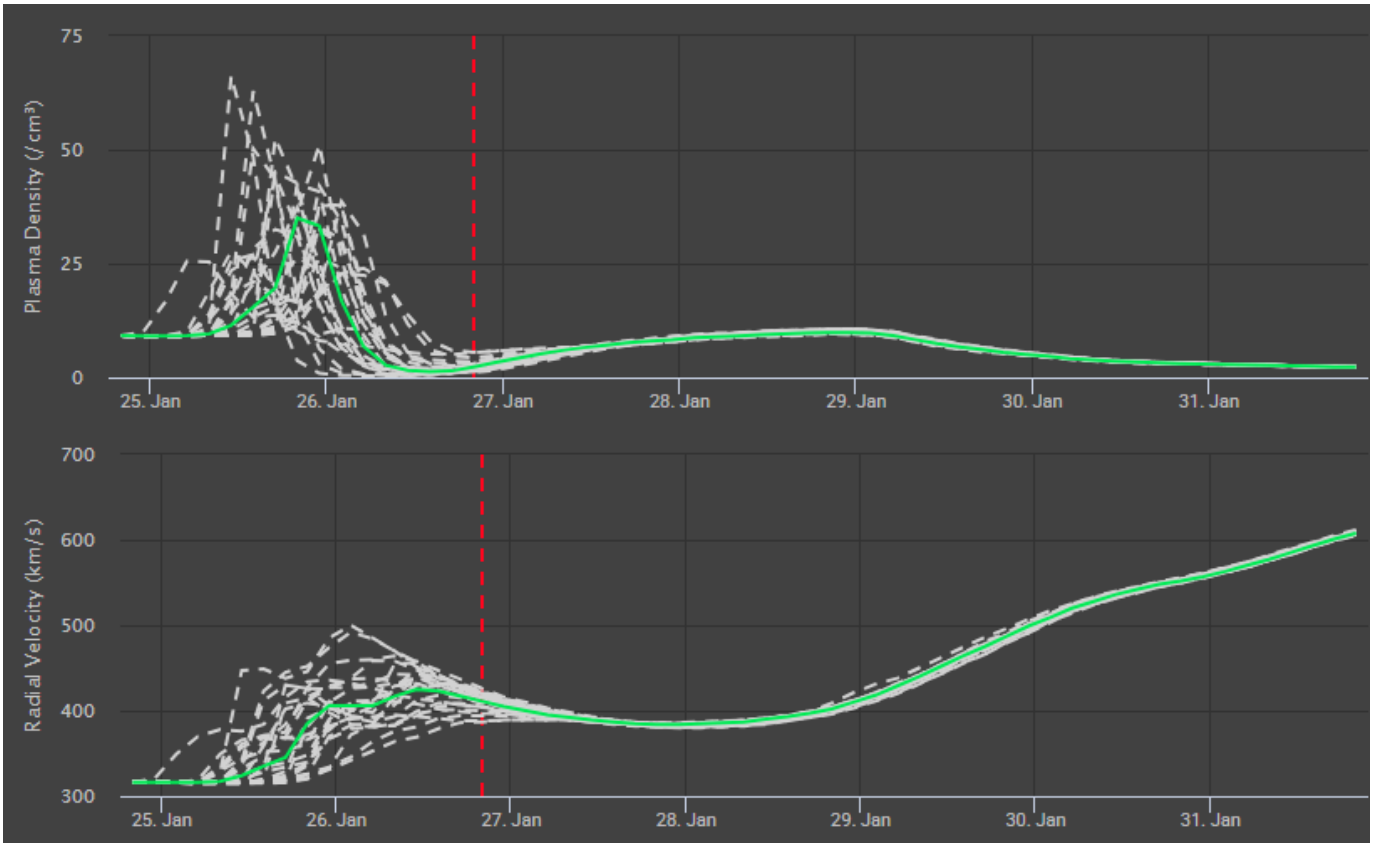
Figure 2: MOSWOC Ensemble model. No significant enhancements are forecast, with the rise in solar winds indicated later in the period likely too early.



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Radio Blackouts - X-Ray Flares

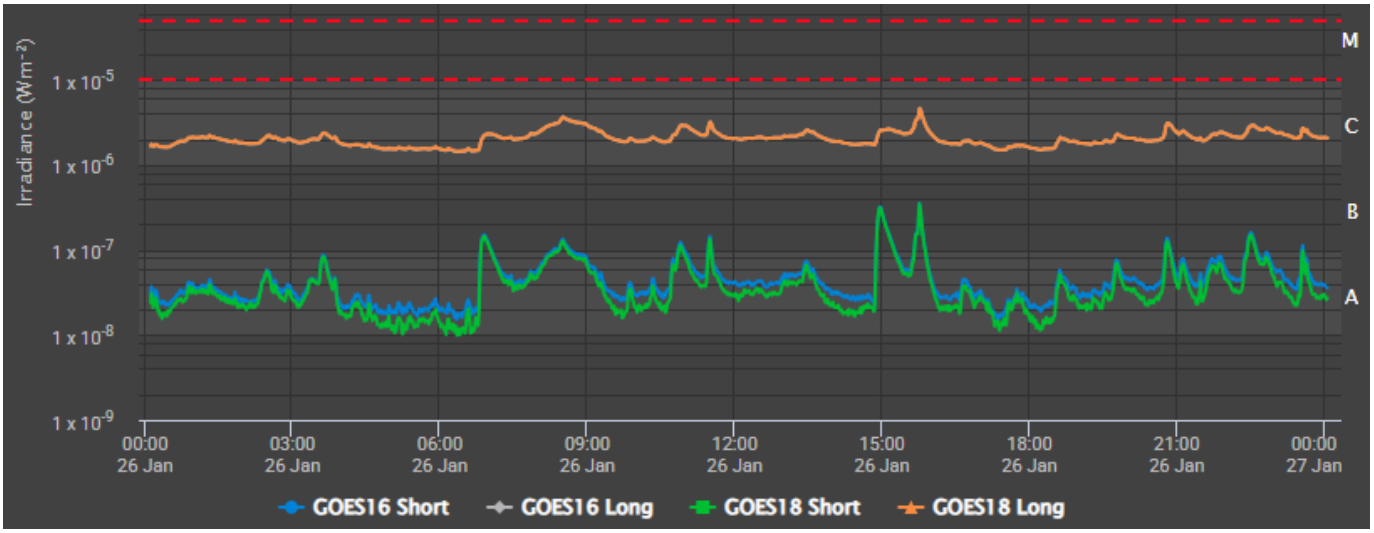
There are currently nine sunspot regions on the Earth-facing disc. The largest and nominally most complex region remains AR3961, soon to rotate around the southwestern limb. This group has shown fading in its central and trailing portions, where a weak delta spot has previously been seen, but is now difficult to accurately assess due to the viewing angle at the limb. AR3971, a bipolar region approaching the northwest limb, is the largest of the other groups and has shown a weakening trend in recent imagery. AR3967, a small bipolar group in the southwest, has shown some development and growth with minor spot emergence. A new region rotating onto the southeast disc has been numbered AR3974. Remaining regions are small and magnetically simple, and either stable or showing some weakening.

This means that trends in the coming four-day forecast period will rely on a balance between the departure of AR3961 and any east limb arrivals, with some suggestion of activity here given a series of CMEs emitted from over the east limb in recent days.

Overall, the daily flare risk is reduced after AR3961 rotates away from the west limb, with a rise noted later in the period to account for oncoming regions. This is likely to be revised once any new regions become visible in the eastern hemisphere. Low to Moderate solar activity is expected with a chance of isolated M-class flares and a slight chance of X-class flares.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	50	30	30	40
Very Active	R3-R5 (X Class)	No	10	5	5	5

Figure 3: GOES-16 & -18 X-ray flux



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Solar Radiation Storms (High Energy Protons)

Proton flux is currently at background levels, and is most likely to stay that way. However, there is a slight chance of it rising above the S1/Minor Radiation Storm threshold in the coming days, mainly due to AR3961 which is rotating over the western limb. This region will have rotated well away from the west limb by Day 3 (29 Jan) so this risk declines towards the end of the period.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	10	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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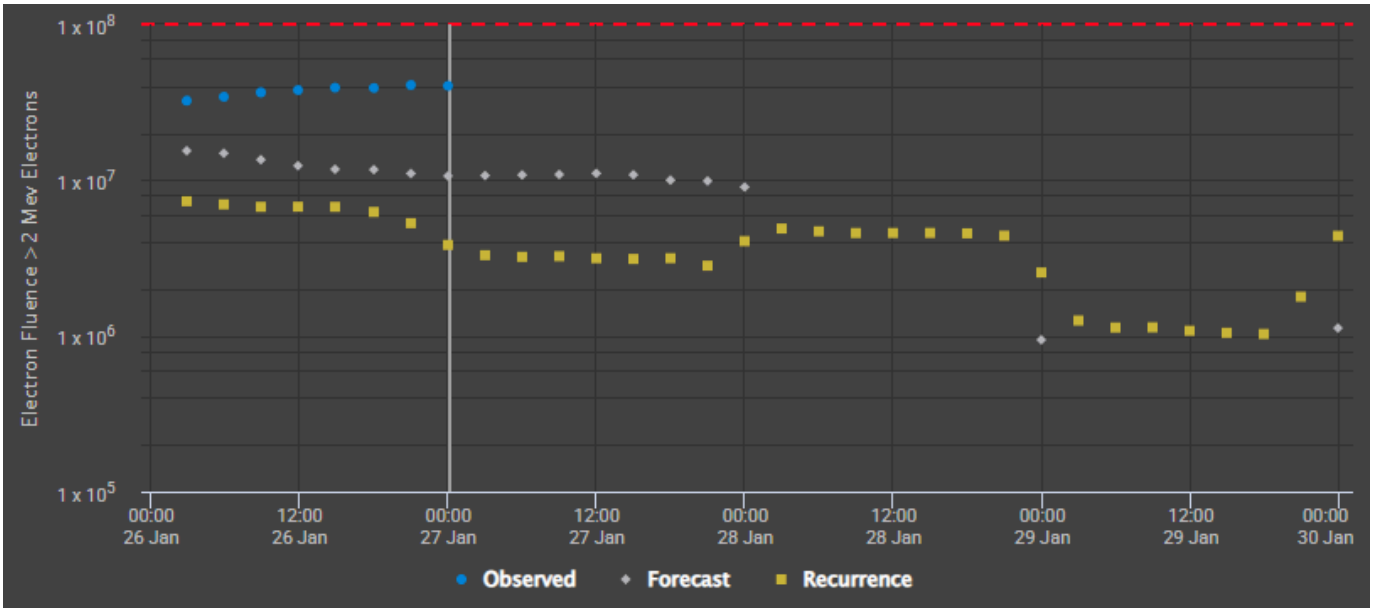
High Energy Electrons (≥ 2MeV)

High energy electron flux observed at GOES16 has been mostly at moderate levels in the last couple of days, after previous diurnally high peaks. This followed a connection to CH09/-, with this feature now lying over the western limb and wind speeds having returned to background levels. In the absence of further CME or HSS activity, a gradual decline in flux levels is forecast. Any CME arrival early on Day 1 (27 Jan) could produce a rapid decline in flux levels at GEO, potentially followed by a rise later in the period depending on the activity associated with the CME. However, this feature may have missed Earth so confidence is low in this aspect and looks increasingly unlikely.

The corresponding 24-hour fluence is expected to remain below the Active threshold, with a gradual downward trend. MOSWOC REFM is felt to be giving good guidance here, although the drop off could be much faster than REFM signals should the CME arrive in the coming hours.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: MOSWOC REFM model. Observation currently slightly higher than model, but general downwards trend looks a reasonable guide.



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